REMARKS

The Applicants respectfully request further examination and consideration in view of the above amendments and the arguments set forth fully below. Claims 2-21 were previously pending in this application. Within the Office Action, Claims 2-21 have been rejected. By the above amendments, Claim 2-16 and 18-19 have been amended. Accordingly, Claims 2-21 are currently pending.

Claim Objections and Rejections Under 35 U.S.C. § 112

By the above amendment to Claims 15, 16, 18 and 19, appropriate corrections have been made to the "informality" objections specifically noted on Page 2 of the Office Action and the "omnibus type claim" rejection on Page 3 of the Office Action.

Claim Rejections Under 35 U.S.C. § 101

By the above amendments to Claims 2-15, appropriate corrections have been made to the 35 U.S.C. § 101 rejections specifically noted on Page 3 of the Office Action. Specifically, the Claims have been amended to include "A method of generating soft value vectors for soft decision decoding within a TPC system..." Thus, the mathematical algorithm included in the body of Claims 2-15 produce a tangible, useful result, namely, generating soft value vectors for soft decision decoding, and thus is limited to a practical application. As such, amended Claims 2-15 fall comfortably within the scope of section 101.

Rejections Under 35 U.S.C. § 103

Claims 16-21 have been rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,594, 318 issued to Sindhushayana (hereinafter, "Sindhushayana").

Specifically, it is stated that Sindhushayana teaches a technique for computing soft-decision metrics to a turbo decoder and a method of approximating log-likelihood ratio metrics for a plurality of turbo encoded symbols, the plurality of turbo encoded symbol having been modulated with quadrature amplitude modulation (QAM) signal constellations having gray code labeling, is provided and further the method includes the steps of extracting a complex-valued modulation symbol soft decision on a modulation symbol, whereby the complex-valued modulation symbol soft decision having an in-phase component (I) and a quadrature component (Q); scaling the complex-valued modulation symbol soft decision to obtain a log-likelihood ratio

metric for a most-significant code symbol of the modulation symbol (see figure 8 elements 406, 410, 412, 414 and col. 3, lines 27-48). Further, Sindhushayana in Figure 2 discloses a receiver (40) includes a demodulator (44) coupled to an automatic gain control (AGC) (46) that is coupled to a converter (ADC) (48) whereby the output of the ADC represents digital samples provided to LLR computation circuit (see col. 10, lines 22-33). Not explicitly disclosed is converting module for converting the LLR result of (I, Q) symbols into unsigned values. However, Sindhushayana teaches a common scale, referred to as log-likelihood ratio (LLR) probabilities, represents each bit by an integer in some range, e.g., [-32,31] and a value of 31 (unsigned or positive) signifies a zero with very high probability and a value of -32 signifies a one with very high probability (see col. 2, lines 37-45). Therefore, it would have been obvious to a person having an ordinary skill in the art at the time the invention was made to represent the converted LLR result as signed or unsigned values since assigning as signed or unassigned is conventional and well known. This modification would have been obvious because a person having ordinary skill in the art would have been motivated to simplify the decoding configuration and maximize the decoding efficiency." The Applicants respectfully traverse this rejection.

Sindhushayana discloses a pure hardware solution for a TCP decoder. [Sindhushayana, Figure 5]. Specfiically, Sindhushayana discloses a hardware improvement and original hardware QAM-based TPC decoder for generating soft decision vectors (soft value vectors). The soft decision vectors in Sindhushayana are used to process an encoded signal to obtain a resulting decoded signal or output. Sindhushayana discloses a block diagram of a circuit for computing a carrier signal-to-interference ratio (C/I) that is coupled as input to a log-likelihood ratio circuit [Sindhushayana, Figure 5]. Sindhushayana also discloses several log-likelihood ratio (LLR) estimation circuits and devices having several multipliers for generating LLR probabilities based on inputs provided by the C/I circuit. [Sindhushayana, Figures 5-7; column 14, lines 6-10 and lines 49-53; and column 12, lines 31-35]. The LLR probabilities are used to determine the soft decision vectors and specifically whether a given symbol was transmitted given a particular received symbol. **Sindhushayana does not disclose approximating a log-likelihood result of an input signal that is independent of a signal to noise ratio. Sindhushayana also does not disclose a software solution within a TPC system for generating soft value vectors. More specifically, Sindhushayana does not disclose generating LLR probabilities using embedded software on a chip.**

In contrast to the teachings of Sindhushayana, the method and apparatus of the present invention disclose a software and hardware enhancement to a TPC encoder and decoder system. In one embodiment, a software algorithm embedded on a chip is used for generating LLR probabilities to determine the soft value vectors. The LLR approximation method of the present invention takes an expression with a natural logarithm and exponentials and reduces it to a set of linear equations. The LLR approximation is implemented as embedded software within hardware and is independent of a signal to noise ratio result. In one embodiment, the software is embedded within a PSK-module and computes the LLR of data in pairs by implementing the LLR equations for the LLR approximation. [Present Invention, Figure 5]. As described above, Sindhushayana does not teach or disclose approximating a LLR result of an input signal that is independent of a signal to noise ratio result. Sindhushayana does not teach generating LLR probabilities using embedded software on a chip. Instead, Sindhushayana discloses a pure hardware solution using several multipliers for generating the LLR probabilities.

The amended Independent Claim 2 is directed to a method of generating soft value vectors for soft decision decoding within a TPC system. The method comprises the steps of receiving an input signal over a channel and approximating a Log-Likelihood-Ratio result of the input signal using embedded software on the system, wherein the Log-Likelihood-Ratio result is independent of a signal to noise ratio value calculable over the channel. As described above, Sindhushayana does not teach or disclose approximating a LLR result of an input signal that is independent of a signal to noise ratio result. Sindhushayana also does not teach approximating LLR results using embedded software on a chip. For at least these reasons, the amended Independent Claim 2 is allowable over the teachings of Sindhushayana.

Claims 2-9 are dependent upon the amended independent Claim 2. As discussed above, the amended independent Claim 2 is allowable over the teachings of Sindhushayana. Accordingly, Claims 2-9 are allowable as being dependent upon an allowable base claim, and are now in condition for allowance.

The amended Independent Claim 10 is directed to a method of generating soft value vectors for soft decision decoding over a channel within a TPC system. The method comprises the steps of receiving an input signal over the channel, wherein the input signal has a plurality of m bits per symbol; calculating an actual Log-Likelihood-Ratio value for each of the plurality of m bits per symbol using embedded software on the system; determining a slope for the actual Log-Likelihood-Ratio value of each m bit; and quantizing the slope for each m bit per symbol and generating a Log-Likelihood-Ratio result, wherein the Log-Likelihood-Ratio value is

independent of noise over the channel. As described above, Sindhushayana does not teach or disclose approximating a LLR result of an input signal that is independent of a signal to noise ratio result. Sindhushayana also does not teach calculating an actual LLR value using embedded software on a chip. For at least these reasons, the amended Independent Claim 10 is allowable over the teachings of Sindhushayana.

Claims 11-14 are dependent upon the amended independent Claim 10. As discussed above, the amended independent Claim 10 is allowable over the teachings of Sindhushayana. Accordingly, Claims 11-14 are allowable as being dependent upon an allowable base claim, and are now in condition for allowance.

The amended independent Claim 15 is directed to a method of generating soft value vectors for soft decision decoding over a modulated channel within a TPC system wherein a signal to noise ratio is calculated over the channel. The method comprises the steps of receiving an input signal over the channel, wherein the input signal has a plurality of m bits per symbol; calculating an actual Log-Likelihood-Ratio value for each of the plurality of m bits per symbol using embedded software on the system, wherein the actual Log-Likelihood-Ratio value includes a SOFT_BITS value for each of the plurality of m bits per symbol; separating the actual Log-Likelihood-Ratio values into one or more n-regions, wherein n is an integer; determining a constant, a_n by computing a partial derivative for the actual Log-Likelihood-Ratio values in the one or more n-regions; calculating a slope by use of a linear equation, wherein the linear equation utilizes the constant a_n; and quantizing the constant a_n by utilizing the quantizing equation

$$Quantize = \left(LLR \frac{2^{SOFT\_BITS-1}}{qLIMIT} + 2^{SOFT\_BITS-1} \right)$$

wherein the SOFT_BITS value and qLIMIT are dependent on the signal to noise ratio, the quantizing equation generating a quantized Logarithmic-Likelihood-Ratio result substantially independent of the signal to noise ratio over the channel. As described above, Sindhushayana does not teach or disclose approximating a LLR result of an input signal that is independent of a signal to noise ratio result. Sindhushayana also does not teach calculating an actual LLR value using embedded software on a chip. For at least these reasons, the amended Independent Claim 15 is allowable over the teachings of Sindhushayana.

The amended independent Claim 16 is directed to a Logarithmic Likelihood Ratio module for generating soft value vectors for soft decision decoding over a modulated channel

within a TPC system. The Logarithmic Likelihood Ratio module comprises an input module for receiving a plurality of data symbols; a soft-ware based modulation unit for determining a modulation scheme for calculating a Logarithmic Likelihood Ratio result for the plurality of data symbols, wherein the Logarithmic Likelihood Ratio result is substantially independent of a signal to noise ratio over the modulated signal; and a converter module for converting the Logarithmic Likelihood Ratio result of the plurality of data symbols into unsigned values. As described above, Sindhushayana does not teach or disclose approximating a LLR result of an input signal that is independent of a signal to noise ratio result. Sindhushayana also does not teach calculating a LLR result using embedded software on a chip. For at least these reasons, the amended Independent Claim 16 is allowable over the teachings of Sindhushayana.

Claims 17-21 are dependent upon the amended independent Claim 16. As discussed above, the amended independent Claim 16 is allowable over the teachings of Sindhushayana. Accordingly, Claims 17-21 are allowable as being dependent upon an allowable base claim, and are now in condition for allowance.

For the reasons given above, Applicant respectfully submit that the Claims 2-21 are in a condition for allowance, and allowance at an early date would be appreciated. Should the Examiner have any questions or comments, the Examiner is encouraged to call the undersigned at (408) 530-9700 to discuss the same so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,
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CERTIFICATE OF MAILING (37 CFR§ 1.8(a))

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